Superfund Program
Proposed Plan

U.S. Environmental Protection Agency,
Region 2

Welsbach/General Gas Mantle Contamination Superfund Site

July 2011

EPA ANNOUNCES PROPOSED PLAN

The United States Environmental Protection Agency (EPA) is issuing this Proposed Remedial Action Plan (Proposed Plan) to present EPA's Preferred Alternative (Preferred Alternative) for Operable Unit Two (OU2, Armstrong Building) of the Welsbach/General Gas Mantle Contamination Superfund Site (Site) in Camden and Gloucester City, New Jersey (NJ).

The Preferred Alternative described in this Proposed Plan is to decontaminate contaminated building surfaces in the Armstrong Building and dispose of the decontamination waste at a permitted off-site facility. EPA will also conduct appropriate environmental testing to ensure the effectiveness of the cleanup.

This Proposed Plan summarizes information from the July 2011 Remedial Investigation and Feasibility Study (RI/FS) report for OU2. EPA is the lead agency for the Site and the New Jersey Department of Environmental Protection (NJDEP) is the support agency.

This Proposed Plan is being issued as part of EPA's public participation requirements under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA) 42 U.S.C. § 9617(a), commonly known as Superfund, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The public's comments will be considered and discussed in the Responsiveness Summary of the Record of Decision (ROD), which will document EPA's selected remedy. This Proposed Plan summarizes information that can be found in greater detail in the RI/FS report for OU2. The RI/FS and other supporting documents for this Proposed Plan are contained in the Administrative Record File for the Site, which is available at the locations listed above. EPA encourages the public

DATES TO REMEMBER:
MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
July 21 - August 22, 2011

EPA will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING: August 3, 2011

EPA will hold a public meeting to explain the Proposed Plan. EPA will also accept oral and written comments at the meeting. The meeting will be held at 7:00 p.m.at the

Gloucester City Courthouse at City Hall
313 Monmouth Street
Gloucester City, New Jersey

For more information, see the Administrative Record at the following locations:

U.S. EPA Records Center, Region 2
290 Broadway, 18th Floor.
New York, New York 10007-1866
(212) 637-3261
Hours: Monday-Friday - 9 am to 5 pm

Camden Library- Ferry Avenue Branch
852 Ferry Avenue
Camden, NJ 08104
(856) 757-7640
Hours: Monday - Friday: 9 am – 5 pm

Gloucester City Public Library
Monmouth and Hudson Streets
Gloucester City, NJ 08030
(856) 456-4181
Hours: Monday – 12 pm to 9 pm
Tuesday and Friday – 9 am to 5 pm
Wednesday and Thursday – 9 am to 9 pm
Saturday – 10 am to 1 pm

Heart of Camden
1840 Broadway
Camden, New Jersey 08104
(856) 966-1212
Hours: By appointment

to review these documents in order to gain a more comprehensive understanding of the Superfund activities that have been conducted at the Site.

SITE HISTORY

Between the 1890s and 1940s, the Welsbach Company (Welsbach) manufactured gas mantles at its facility in Gloucester City, NJ. Beginning around 1895, Welsbach imported monazite ore to use as its source of the radioactive element thorium. Welsbach extracted thorium from the ore and used it in its gas mantle manufacturing process since thorium caused the mantles to glow more brightly when heated. Just after the turn of the 20th century, Welsbach was the largest producer of gas mantles and lamps in the United States, making up to 250,000 mantles per day. It appears that around 1915, Welsbach moved its operations from the property along the southwestern corner of Ellis and Essex Streets to the newly built Armstrong Building and other buildings on the north side of Essex Street. Welsbach went out of business in 1940.

A second gas mantle manufacturing company, General Gas Mantle (GGM), located in Camden, NJ, was a small competitor to Welsbach. GGM operated from 1912 to 1941. While there is little information on its activities, it appears that GGM only used refined thorium in its gas mantle manufacturing processes.

During the years Welsbach was in operation, ore tailings and other wastes were used as fill throughout Gloucester City. Over the past 100 years, a number of Welsbach buildings were demolished and the building debris may also have been used as fill in the Gloucester City area.

The Site was initially identified by EPA as part of its investigation at the U.S. Radium Corporation Superfund Site in Orange, NJ. Records from U.S. Radium indicated they had purchased radium from Welsbach. In 1981, as a result of this information, EPA sponsored an aerial radiological survey of the Camden and Gloucester City area to investigate the possible presence of radioactive contamination. Based on an evaluation of these data, EPA identified six study areas for the Site.

WELSBACH/GENERAL GAS MANTLE CONTAMINATION SUPERFUND SITE STUDY AREAS

Study Area 1 - includes the former GGM facility and residential and commercial properties that surround the GGM facility.

Study Area 2 - includes the location of the former Welsbach facility and nearby residential/commercial properties. The Armstrong Building is located on the former Welsbach facility.

Study Area 3 - includes residential and recreational properties in Gloucester City.

Study Area 4 - includes residential properties in the Fairview section of Camden.

Study Area 5 - includes residential properties, vacant land, and two municipal parks near Temple Avenue and the South Branch of Newton Creek in Gloucester City.

Study Area 6 - includes residential and commercial properties, as well as vacant land, near Market, Powell, and Seventh Streets, in Gloucester City.

In 1996, EPA placed this Site on the National Priorities List, and in1997, EPA contracted Malcolm Pirnie, Inc. to perform an RI/FS for the Site. The RI/FS was finalized in January 1999. In July 1999, EPA issued a ROD for the first of four operable units (OU1). The selected remedy for OU1 included excavation and off-site disposal of radiologically contaminated soil and waste materials from the former Welsbach and GGM facilities and the nearby residential and commercial properties. The remedy also included decontamination and demolition of the GGM building.

In 2002, EPA conducted ecological investigations and developed human health and ecological Risk Assessments (RAs) for the surface water, sediments and wetland areas along the South Branch of Newton Creek, Martin's Lake, and the Delaware River (OU3). In July 2005, EPA issued a ROD for OU3, which indicated that no remedial action was necessary for surface water, sediments, and wetlands at the Site.

This Proposed Plan for OU2 addresses radioactive contamination in the Armstrong Building, the last remaining building from Welsbach's operations. A fourth operable unit is planned to investigate potential groundwater contamination associated with the Site.

OU1 - REMEDIAL ACTIONS IMPLEMENTED TO DATE

To date, EPA has removed and disposed of more than 200,000 cubic yards of radiologically contaminated soil and waste material from the Site as part of OU1 cleanup activities. These activities include:

Camden

- Demolition of the former GGM building and the adjacent Dynamic Blending building.
- Excavation and disposal of radiologically contaminated soils on the following properties:
  - The former GGM facility and nearby properties.
  - About 40 residential properties.
  - A property on Jasper Street that is the site of a community theater.

Gloucester City

- Excavation and disposal of radiologically contaminated soils on the following properties:
  - Gloucester City Swim Club and the adjacent residential properties along Essex Street.
  - The Gloucester City Land Preserve and North Ball Fields along Johnson Boulevard.
  - About 40 other residential properties including those between Highland Boulevard and Klemm Avenue, and Temple Avenue adjacent to Newton Creek.
  - A property on Sixth Street, between Division and Hunter Streets that is the proposed site of a new middle school.

OU2 SITE CHARACTERISTICS

Armstrong Building Site History

The Armstrong Building is a three-story building located at Ellis and Essex Streets, in Gloucester City. The property the Armstrong Building is located on includes an active port, warehouse, and logistics facility, currently owned by GMT Realty Limited Liability Company (LLC). The port facility is operated by Gloucester Marine Terminal, LLC through Holt Logistics.

The Armstrong Building consists of six connected buildings containing approximately 200,000 square feet of floor space. It has three basement areas and three above-ground stories, and is constructed of masonry and reinforced concrete.

From around 1915 to 1940, the Armstrong Building was one of the buildings used in the manufacturing of gas mantles. Welsbach extracted the radioactive elements thorium and radium from monazite sand; thorium was used to manufacture gas mantles, while the radium was sold to other parties for use in luminescent paint.

In 1942, the U.S. Government acquired the Welsbach Facility and sold it to the Randall Corporation in 1948. Randall leased the property to the Radio Corporation of America, Victor Division. A series of intervening owners followed. In 1976, Holt Cargo Systems (Holt Cargo) purchased the former Welsbach property and used the Armstrong Building for offices, warehousing operations, and storage.

Contaminants of Concern

The primary radionuclides of concern at the Armstrong Building, Thorium-232 (Th-232) and Radium-226 (Ra-226), are from the thorium and radium series decay chains. With half-lives of 14 billion years and over 1,600 years, respectively, both Th-232 and Ra-226 are extremely long-lived. Therefore, radioactive decay does not contribute significantly toward their degradation in the environment.

Site Conditions

The entire port facility is privately secured. The closest residential property is approximately 400 feet east of the Armstrong Building. The Walt Whitman Bridge is located immediately to the north and the Delaware River is located approximately 1,000 feet to the west.

At present, the Armstrong Building is in poor physical condition. Many of the exterior walls on the 2nd and 3rd floors of the building, as well as the 3rd floor ceiling, are open to the environment. Due to the condition of the building, only a few rooms on the 1st and 2nd floors are currently being used by Holt Logistics for offices, warehousing operations, and storage with a small portion of the 2nd floor of the building used for offices and training.

Enforcement History

In May 1997, Holt Cargo, the former owner of the Armstrong Building property, voluntarily entered into an Administrative Order on Consent (AOC) with EPA to conduct a radiological investigation of the building. In accordance with the terms of the AOC, Holt Cargo agreed to conduct an RI/FS for the Armstrong Building. Holt Cargo contracted with Integrated Environmental Management, Inc. (IEM) to conduct this investigation. Under the AOC, Holt Cargo submitted the following reports to EPA:

- *Remedial Investigation Report for the Armstrong Building*, July 1998
- *Comparative Analysis of Remedial Alternatives*, May 1999
- *Baseline Risk Assessment for the Armstrong Building*, January 2000
- *Feasibility Study for the Armstrong Building*, January 2000 (IEM, 2000b)

OU2 INVESTIGATIONS

NJDEP

In 1991, the NJDEP conducted an investigation at the Armstrong Building consisting of surface exposure rate and working level measurements. During this investigation, elevated surface exposure rate readings (exposure rates not specified) were found on the 2nd and 3rd floors. In addition, elevated working level measurements were found on the 2nd floor in Room 9 and on the 3rd floor in Rooms 15, 16, 17, 19, and 20. No elevated readings were found on the 1st floor.

IEM RI

In 1998, IEM, on behalf of Holt Cargo, conducted an RI at the Armstrong Building. Prior to conducting any field work, IEM divided the building into affected and unaffected areas based on the 1991 NJDEP investigation. Affected areas were those areas where radioactive materials were likely to have been used, handled, or stored and/or areas identified by NJDEP as potentially contaminated.

IEM conducted the following surveys during the RI:

- Floor Scans - A floor monitor, calibrated to respond to alpha radiation, was used to scan potentially affected floor surfaces.
- Walls Scans - Where practicable, a similar approach was used for the walls. In affected areas, all wall surfaces were scanned from the floor to a height of approximately six feet (the approximate height of an adult). In addition, approximately ten percent of the wall areas higher than six feet were scanned; these areas were randomly selected.
- Alpha Radiation Measurements - At floor or wall surfaces where the scanning measurements found residual alpha radiation activity above the project criterion, more definitive measurements were collected to confirm and quantify the level of alpha radiation.
- Horizontal Surface Samples/Alpha Radiation Measurements - For horizontal surfaces (*i.e.*, floors, pipes) with elevated readings, a sample

was collected to determine the level of removable activity (*i.e.*, capable of spreading). A second alpha radiation measurement was collected at this location to determine the amount of contamination that is fixed in place (*i.e.*, cannot spread without disturbance).

- Building Materials Sampling - 109 samples of building materials (*e.g.*, concrete, brick) were collected and sent to an off-site laboratory for analysis.

IEM did not investigate some areas of the Armstrong Building due to non-radiological health and safety concerns or accessibility issues. These included the following:

- The access to the elevator shaft and stairway on all three floors located between Rooms 16 and 27 (deemed structurally unsafe).

- A "connector" between Room 16 and either Room 21 or 22 (deemed structurally unsafe).

- Exterior walls underneath drains (inaccessible).

- Portions of the basement (filled with debris).

- 1st floor warehouse (areas with poured concrete over the original floor).

- Painted areas on walls and columns and areas under floor tiles (IEM conducted alpha scans; alpha scans are ineffective on covered surfaces).

- A below-grade pipe chase (inaccessible).

- Inaccessible wall areas in four rooms (Rooms 11, 12, 14, and 20) that were covered by insulation and other materials.

- The roof, including exhaust vents and the ceiling in Rooms 21 and 22.

A copy of IEM's RI Report is included in the Administrative Record for the Site.

<u>ARCADIS/Malcolm Pirnie RI</u>

In 2010, ARCADIS/Malcolm Pirnie, under a contract with the U.S. Army Corps of Engineers, conducted a supplementary RI at the Armstrong Building to fill some potential data gaps in IEM's RI/FS. The focus of the ARCADIS/Malcolm Pirnie supplementary RI was on the building material surfaces in the rooms on the 2nd and 3rd floors of the Armstrong Building since the NJDEP and IEM did not find any Welsbach-related radioactive contamination on the 1st floor.

The purpose of the supplementary RI was to:

- Confirm the radiological measurements and data collected by IEM during its investigation.

- Collect a limited amount of additional data, to close some data gaps identified in IEM's investigation.

- Determine if IEM's data meet the current data quality objectives of the project and if so, use these data, together with the new data collected by ARCADIS/Malcolm Pirnie to develop a new Baseline RA.

- Reevaluate the technologies and alternatives for remediating radioactive contamination, and associated costs, presented by IEM in its FS.

Surveys conducted during the supplementary RI consisted of the following:

- Beta and/or gamma radiation scans in limited areas (*i.e.*, at select locations or along transects on the floors and along transects, mainly up to a height of six feet, along the walls and columns).

- The collection of samples to determine if contamination is removable.

- Building materials sampling.

- Radon (Radon-222)/thoron (Radon-220) sampling.

Overall, the Supplementary RI results correlated well with IEM's RI results. The ARCADIS/

Malcolm Pirnie Supplementary RI is included in the Administrative Record for the Site.

IEM and ARCADIS/Malcolm Pirnie RI Summary

Both the IEM and ARCADIS/Malcolm Pirnie RIs identified radioactive contamination in four rooms on the 2nd floor (Rooms 9, 10, 11, and 13) and eight rooms on the 3rd floor (Rooms 15, 16, 17, 18, 19, 20, 21, and 22). Radioactive contamination was also found in one stairway.

The following additional information was obtained during the RIs:

- With the exception of Room 11, volumetric building sample results indicate that radioactive contamination is predominantly due to thorium series radionuclides. The radioactive contamination in Room 11 appears to be associated with Ra-226.

- With one exception, the volumetric building material sample results indicate that contamination of building materials is superficial (*i.e.*, contained within the top 1/8 inch of the surface). One volumetric floor sample from Room 11, collected to a depth of 1-1/8 inch, had an elevated Ra-226 concentration.

- Building material contamination varied by room and location within a room and locations within a room were not uniformly contaminated.

- Removable contamination was found on the floors in Rooms 11, 13, 17, and 20.

- Removable contamination was not detected on any of the top horizontal surfaces of the pipes and heating, ventilation, and air conditioning components sampled.

- Radon was detected below 2 picocuries per liter (pCi/L) and thoron was not detected in any of the rooms tested (EPA's action level for radon is 4 pCi/L).

It should be noted that the radiological contamination detected in the Armstrong Building does not meet the criteria of a "principal threat waste", as defined by the NCP.

SCOPE AND ROLE OF ACTION

As with many Superfund sites, the Welsbach Site is complex and has been divided into separate phases of OUs:

OU1 – Addresses the radiologically contaminated soils and waste materials at the former Welsbach and GGM facilities, and other properties in the Camden and Gloucester City area.

OU2 – Addresses the radiological contamination in the Armstrong Building, the last remaining building from Welsbach's gas mantle operations.

OU3 – Evaluated the potential radiological contamination in the surface water, sediment, and wetland areas around the Site.

OU4 – Will evaluate the potential impacts to the groundwater from the radiological contamination at the Site.

The response action described in this Proposed Plan is for OU2. This Proposed Plan summarizes the remedial alternatives detailed in the FS and discusses the Preferred Alternative for addressing radiological contamination on building surfaces and building materials in the Armstrong Building.

SUMMARY OF SITE RISKS

EPA used radiological data from both IEM's RI and the ARCADIS/Malcolm Pirnie supplementary RI to conduct a new Baseline RA since IEM's Baseline RA was more than ten years old and there have been significant updates and improvements in computer modeling that evaluates risk. The new Baseline RA included additional exposure scenarios and human receptors that were identified based on the current owner's plans to demolish the Armstrong Building in the future.

EPA identified three primary risk pathways to human health associated with the Armstrong Building: 1) threat of release of radioactive material from the 2nd and 3rd floors of the building; 2) threat to human health in the event the building is reused without decontamination; and 3) threat to human health in the event the building is demolished and disposed of without decontamination.

Threat of Release of Radioactive Material

The majority of the Armstrong Building is no longer used, with Gloucester Marine Terminals and Holt Logistics using a portion of the 1st floor for offices, warehousing operations, and storage, along with a small portion of the 2nd floor for offices and training. The property owner plans to demolish the building at a future date.

The building, which is over 90 years old, is in poor physical condition with many of the exterior walls on the 2nd and 3rd floors, along with the 3rd floor ceiling, open to the environment. Several rooms on the 3rd floor where the ceiling has collapsed or where the roof is leaking have extensive water damage, and moss and some plants are growing in the water-damaged areas. In addition, wildlife (*e.g.*, rodents, feral cats, pigeons) lives on portions of the 2nd and 3rd floor. Due to these factors, the deterioration of the building is expected to continue. As this deterioration continues over time, it is expected that the threat of a release of radioactive contamination to the environment will increase through various release mechanisms, such as fire and/or building collapse.

Threat to Human Health

In 2011, ARCADIS/Malcolm Pirnie developed a Baseline RA for the Armstrong Building that evaluated the current and future risks posed to humans by exposure to Th-232 and Ra-226, along with their decay products, in the Armstrong Building. EPA classifies all radionuclides as known human cancer causing agents (Group A carcinogens); therefore, cancer risk associated with their radiotoxicity is the primary concern and incremental cancer risk from exposure to radioactive contamination, along with their decay products, is the only health effect of concern at the Armstrong Building. Additionally, non-cancer toxicity values are not available for the radionuclides of concern; therefore, non-cancer

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at a site in various media (*e.g.*, soil, building materials, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants in air, water, soil, etc. identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a “reasonable maximum exposure” scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health hazards, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a “one in ten thousand excess cancer risk”; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one in ten thousand to a one in a million excess cancer risk. For non-cancer health effects, a “hazard index” (HI) is calculated. The key concept for a non-cancer HI is that a “threshold” (measured as an HI of less than or equal to 1) exists below which non-cancer health hazards are not expected to occur. The goal of protection is 10^{-6} for cancer risk and an HI of 1 for a non-cancer health hazard. Chemicals that exceed a 10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at the site and are referred to as COCs in the ROD.

hazards were qualitatively evaluated in the Baseline RA.

Risk Assessment

According to EPA, cleanups of radionuclides are governed by the risk range for all carcinogens established in the NCP, when applicable or when relevant and appropriate requirements are not available or are not sufficiently protective. For known or suspected carcinogens, the NCP established that acceptable exposure levels are generally concentration levels that represent an incremental upper-bound lifetime cancer risk in the range from 10^{-4} (*i.e.*, 1×10^{-4} or 1 in 10,000) to 10^{-6} (*i.e.*, 1×10^{-6} or 1 in 1,000,000) or less.

Potential receptors and exposure pathways identified for the Armstrong Building Baseline RA were based on current and future land use, the physical condition of the building, and the radioactive contamination identified. The exposure routes were evaluated as appropriate for the potential receptors. The following populations and scenarios were evaluated in the Baseline RA.

<u>Catastrophic release/general public exposure scenario</u> – Due to the deteriorated condition of the Armstrong Building, a catastrophic release is possible through several mechanisms including fire or building collapse. The population evaluated included the general public in the vicinity of, and downwind of the building, with a potential exposure pathway of inhalation.

Based on this evaluation, an incremental lifetime cancer risk of 2 in 10,000 (2×10^{-4}), which is near the upper bound of the acceptable cancer risk range, was calculated for a receptor on the adjacent Walt Whitman Bridge.

<u>Building demolition exposure scenarios</u> – This scenario was modeled since the current owner plans to demolish the building at a future date. Potential receptors include demolition workers inside the building and hypothetical residents living in a residence built above buried debris from the demolished building. Potential exposure pathways evaluated include external exposure, inhalation via radon/thoron or airborne dust, and ingestion.

The incremental lifetime cancer risks for these scenarios are as follows:

- Demolition worker – an incremental lifetime cancer risk of 2 in 100,000 (2×10^{-5}) was calculated, which is within the cancer risk range.

- Hypothetical Resident – risks ranged from 2 in 10,000 (2×10^{-4}) for an adult, which is near the upper bound of the risk range, to 3 in 100,000 (3×10^{-5}) for a child, which is within the cancer risk range.

<u>Building reuse/occupational and residential exposure scenarios</u> – This assessment evaluated the potential for exposure to both indoor workers and residents under the assumption that the building is renovated in the future for either commercial/industrial or residential use. This scenario was evaluated since the radionuclides of concern, Th-232 and Ra-226, do not degrade significantly in the environment over time. Therefore, it is expected that radioactive contamination will be present in the Armstrong Building for well beyond the foreseeable future. Potential exposure pathways evaluated include external exposure, inhalation via radon/thoron or airborne dust, and ingestion.

The incremental lifetime cancer risks for the building reuse exposure scenarios are as follows:

- Future Indoor Workers –
  - For all rooms except Room11, risks ranged from 4 in 100,000 (4×10^{-5}), which is within the risk range, to 9 in 10,000,000 (9×10^{-7}), which is below the risk range.

  - For Room 11, a risk of 5 in 10,000 (5×10^{-4}) was calculated, which is greater than the risk range.

- Future Resident Adult –
  - For Room 11, a risk of 3 in 1,000 (3×10^{-3}) was calculated, which is greater than the risk range.

- For Room 17, a risk of 6 in 10,000 (6×10^{-4}) was calculated, which is greater than the risk range.

- For the following rooms, all risks were near the upper bound of the risk range:

  - Room 9 (3 in 10,000 or 3×10^{-4}).

  - Room 10 (3 in 10,000 or 3×10^{-4}).

  - Room 13 (2 in 10,000 or 2×10^{-4}).

  - Room 15 (2 in 10,000 or 2×10^{-4}).

  - Room 21 (3 in 10,000 or 3×10^{-4}).

  - Area A (2 in 10,000 or 2×10^{-4}).

- For all other rooms and areas, risks ranged from 1 in 10,000 (1×10^{-4}) to 8 in 100,000 (8×10^{-5}), which is within the risk range.

- Future Resident Child –
  - For Room 11, a risk of 6 in 10,000 6×10^{-4}), which is greater than the risk range, was calculated.

  - For all other rooms and areas, risks ranged from 1 in 10,000 (1×10^{-4}) to 8 in 1,000,000 (8×10^{-6}), which is within the risk range.

Based on the results of the RA, the following radionuclides of concern were identified in the Armstrong Building:

- Th-232 in Rooms 9, 10, 13, 15, 17, 21, and Area A.

- Ra-226 in Room 11.

Actual or threatened releases of hazardous substances from this portion of the Site, if not addressed by the preferred alternative, or the other active measure considered, may present a current or potential threat to public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

To protect the public and the environment from potential current and future health risks, the following remedial action objectives were developed for the Armstrong Building:

- Prevent radiation exposure from radiological contamination on building surfaces.

- Prevent future release of radioactive contamination from the Armstrong Building to the environment.

To determine what areas of the Armstrong Building require remediation, risk-based Preliminary Remediation Goals (PRGs) were developed based on the results of the ARCADIS/Malcolm Pirnie Baseline RA. The following PRGs were derived for both Th-232 and Ra-226:

- **Th-232** - 500 disintegrations per minute per 100 square centimeters (dpm/100 cm^2)

- **Ra-226** - 1,000 dpm/100 cm^2

EPA has selected the more conservative Th-232 PRG of 500 dpm/100 cm^2, not including background, for both fixed and removable contamination as the Remediation Goal (RG) for OU3. This RG was selected since:

- The majority of the rooms are contaminated with Th-232.

- Alpha, beta, and gamma radiation scans, which are used to detect radiation on or within building surfaces, are not radionuclide-specific. Therefore, radionuclide-specific RGs cannot be used.

SUMMARY OF REMEDIAL ALTERNATIVES

For the Armstrong Building, general response actions that address potential future human exposure to radioactive materials include the following:

- No action, which is evaluated under CERCLA to provide a basis for comparison to the other alternatives

- Institutional controls (land use restrictions)
- Engineering controls (containment)
- Active Remediation - building decontamination and building demolition

Institutional controls are non-engineered instruments, such as administrative and legal controls (*e.g.*, land use zoning restrictions, environmental covenants) that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. Engineered controls for surficial radioactive contamination include installation of an engineered physical barrier (*i.e.*, concrete shielding) to prevent contact and minimize exposure to the underlying contaminated material.

EPA considered the feasibility of institutional/engineered controls, along with long-term operation and maintenance (O&M) for the Armstrong Building. However, due to the long half-life of the radionuclides of concern, and since the NCP emphasizes that institutional controls are meant to supplement engineering controls and will rarely be the sole remedy at a site, the institutional/engineered control alternative was not considered practical and sufficiently protective. Therefore, this alternative was not evaluated further in the FS.

The alternatives evaluated in the FS are summarized below. A complete description of the evaluated alternatives is included in the FS, which is in the Administrative Record for the Site.

Alternative 1 – No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth: $0
Estimated Implementation Period: None

Under CERCLA, a "No Action" alternative is evaluated to provide a common basis on which to evaluate the other alternatives. In this alternative, the Armstrong Building would remain in its current condition without any provision for decontamination or engineering and institutional controls. Because the radiological contamination would remain in the building, EPA would be required to conduct reviews of the building every five years.

Since no action would be taken under this alternative, the physical condition of the building is expected to continually degrade over time, increasing the threat of a release of radioactive contamination to the environment via a catastrophic event (*e.g.*, fire, building collapse). If the building is demolished in the future, the radiologically contaminated demolition debris might inappropriately be used as fill. If residences are subsequently built above this fill, residents living above the buried building debris might be exposed to radioactive contamination. Furthermore, if the building were to be converted to residential use in the future, there could be unacceptable risks to human health.

This alternative would not reduce risk to human health to acceptable levels and would not achieve the remedial action objectives.

Alternative 2 – Complete Decontamination (Physical and/or Chemical), Off-Site Disposal

Estimated Capital Cost: $3,500,000
Estimated Annual O&M Cost: $0
Estimated Present Worth: $3,500,000
Estimated Implementation Period: One Year

Physical decontamination is the removal of surface radiological contamination by either surface cleaning or surface removal techniques while chemical decontamination is the removal of contamination through chemical reactions including acid or alkaline dissolution, redox reactions, and chelation. Locations in the Armstrong Building with radioactive levels above the RG would be decontaminated to the required extent using a combination of physical and chemical decontamination techniques.

A combination of different physical and chemical decontamination methods would be evaluated for contaminated building surfaces in the remedial design. Chemical decontamination may be utilized on building surfaces that are non-porous, and free of paint, tiles, and mastic. Chemical decontamination is not effective on porous, painted, or glazed surfaces, and may mobilize radiological or other contaminants when used for these media. Therefore, given the condition and construction of the buildings (brick and mortar walls from the turn of the last century, and painted surfaces on walls and concrete columns), chemical decontamination, if used, would only be effective on the concrete floors. Physical decontamination methods would be effective on the concrete floors, walls, and columns.

During the remedial design, EPA will also investigate the areas that IEM deemed inaccessible. EPA will remediate these areas if contamination is found. To demonstrate the effectiveness of the remedial action, EPA would conduct Final Status Surveys (FSS) in each remediated room. EPA would follow the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) as a guide to ensure that the remedial action objectives have been achieved. This will alleviate the need to conduct further radiological monitoring in the future.

Waste materials from the decontamination process would vary depending on the decontamination method(s) used. These wastes could include concrete, brick and mortar dusts, and mixtures, as well as spent media (*e.g.*, grit, sand, shot). Chemical decontamination wastes vary depending on the method(s) used but generally include liquid mixtures containing reagents and removed contaminants. Liquid chemical wastes typically require stabilization/solidification (*e.g.*, addition of Portland cement, lime, sand or other materials or chemicals) prior to transportation to satisfy disposal facility requirements. These wastes would be collected in drums and/or roll-off dumpsters, and sampled for radiological contaminants and landfill disposal parameters. Based on the analytical results, the waste would be segregated into Unimportant Quantities of Source Material (UQSM) or UQSM-Resource Conservation and Recovery Act (RCRA) waste, and shipped off-site to a licensed and permitted disposal facility.

Alternative 3 – Demolition, Off-Site Disposal
Estimated Capital Cost: $103,000,000
Estimated Annual O&M Cost: $0
Estimated Present Worth: $103,000,000
Estimated Implementation Period: Less than Two Years

Demolition is the complete removal of a building. It is a proven technology for the removal of radiological contamination from buildings and equipment. While a variety of demolition technologies are available, a selective, controlled technique would be required in order to prevent the spread of radiological contamination from the contaminated portions of the building to the environment during the demolition activities. For example, a typical demolition technique, implosion of the building, could generate radiologically contaminated dust. Therefore, this demolition alternative would include a precise and controlled demolition process. It should be noted that implementation of controlled demolition significantly increases cost due to additional time and labor to carefully demolish the building.

Demolition of radiologically contaminated buildings requires use of containment and monitoring measures to prevent migration of fugitive dust. Demolition includes preparing the demolished material for shipping and disposal, which may include segregation, size reduction, and screening of demolition rubble to reduce the volume of waste requiring disposal as UQSM. Given the condition and construction of the Armstrong Building (brick and mortar walls from the early 20th century) and painted surfaces on walls and concrete columns, comprehensive lead-based paint and asbestos surveys and structural/demolition assessment would be required to accurately estimate demolition material quantities, waste streams, and demolition methods for the remedial design and construction. Post-demolition activities would include filling open basements and re-grading the area.

Demolition wastes would include rubble (concrete, reinforced concrete, brick and mortar), structural steel, lumber and plywood, miscellaneous construction debris (e.g., Styrofoam), and heating, ventilation, and air conditioning equipment and ductwork. Based on their origin and known or suspected contamination, these wastes would be stockpiled in a waste storage and processing area or collected in roll-off dumpsters for screening and/or size reduction, and segregation, sampled for radiological contaminants and any analyses required by the landfill for disposal, and, based on the analytical results segregated into UQSM or UQSM-RCRA waste, and shipped off-site to a licensed and permitted disposal facility. Screening and size reduction equipment (e.g., shakers, screeners, hammer mills equipped with conveyors) would be required to segregate non-radiologically contaminated waste materials from the UQSM and UQSM-RCRA waste streams, if applicable.

EVALUATION OF ALTERNATIVES

In accordance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, remedial alternatives for the Armstrong Building were assessed against the nine evaluation criteria in 40 CFR 300, §300.430(e)(7)(iii). The alternative selected must first satisfy the threshold criteria set out in the NCP. Next, the primary balancing criteria are used to weigh the tradeoffs or advantages and disadvantages of each of the alternatives. The modifying criteria, which are State and community acceptance, are evaluated at the end of the public comment period. This section of the Proposed Plan summarizes the relative performance of each alternative against the criteria, noting how it compares with the other options under consideration. Additional information on the comparison of the remedial alternatives can be found in the ARACADIS/Malcolm Pirnie FS report.

1. Overall protectiveness of human health and the environment

Alternative 1 would not achieve this criterion since radioactive contamination associated with the Site would not be removed. Alternatives 2 and 3 would provide overall protection of human health and the environment on a similar basis or level.

As Alternative 1 is not protective of human health and the environment, it is eliminated from consideration under the remaining eight criteria.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

Threshold Criteria

1. *Overall protectiveness of human health and the environment* – Evaluates whether an alternative provides adequate protection and how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with Applicable or Relevant and Appropriate Requirements* – Evaluates whether or not an alternative will meet all applicable or relevant and appropriate requirements of Federal and State environmental statutes and/or justifies a waiver.

Primary Balancing Criteria

3. *Long-Term Effectiveness and Permanence* – Addresses the ability of an alternative to afford long-term, effective, and permanent protection to human health and the environment over time.

4. *Reduction of Toxicity, Mobility, or Volume through Treatment* – Address the extent to which an alternative will reduce toxicity, mobility, or volume of the contaminants causing the site risks.

5. *Short-Term Effectiveness* – Considers the length of time until protection is achieved and the short-term risk or impact to the community, on-site workers, and the environment that may be posed during the construction and implementation of the alternative.

6. *Implementability* – Considers the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement that remedy.

7. *Cost* – Includes estimated capital, O&M, and net present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

Modifying Criteria

8. *State Acceptance* – Address whether the State concurs with, opposes, or has no comment on the Preferred Alternative.

9. *Community Acceptance* – Considers whether the public agrees with EPA's analyses of the Preferred Alternative described in the Proposed Plan.

2. Compliance with ARARs

Actions taken at any Superfund site must meet all ARARs of federal and state law or provide grounds for invoking a waiver of these requirements. These include chemical-specific, location-specific, and action-specific ARARs. There are no chemical or radiological specific ARARs for the contaminated building materials. However, EPA developed risk-based cleanup standards using 10 CFR 300, which establishes acceptable remediation standards to protect human health. Alternatives 2 and 3 would comply with ARARs.

3. Long-Term Effectiveness and Permanence

Alternatives 2 and 3 offer long-term protection of human health and the environment as both remedial actions would be permanent, and all contaminated building materials would be removed from the Site for disposal in an off-site controlled, licensed facility.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction of toxicity, mobility, or volume through treatment for Alternatives 2 and 3. No treatment technology presently exists that will reduce the toxicity, mobility or volume of radium and thorium. However, Alternatives 2 and 3 would reduce the mobility of radiological contaminants by removal, off-site disposal, and management of these wastes at an approved landfill permitted to accept radiological waste.

5. Short-Term Effectiveness

Exposure to radiological contamination by construction workers and the public during implementation of Alternatives 2 and 3 is a potential concern. However, this exposure would be reduced by the use of: on-site engineering control measures for minimizing dust generation; restrictions on the size of area being worked; and other demolition best management practices that would minimize the exposure to particulate contaminants.

6. Implementability

From a technical standpoint, both Alternatives 2 and 3 are implementable as experienced firms, personnel, and equipment are readily available and both alternatives use readily available, proven technologies. From a logistical standpoint, Alternative 2 is readily implementable as only a limited area would be needed for access and staging requirements. Logistically, Alternative 3 would be more difficult to implement since the Armstrong Building is located on a very active port. The limited space for storing and handling of the demolition debris would pose significant access and staging issues for this alternative. Alternative 3 would also generate a significant volume of waste for disposal.

7. Cost

Alternative 3 (demolition) would be significantly more expensive to implement than Alternative 2 (decontamination). The estimated costs for Alternative 2 and 3 are $3,500,000 and $103,000,000, respectively.

8. State Acceptance

The State of New Jersey is currently evaluating EPA's Preferred Alternative in this Proposed Plan.

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends, and will be described in the Responsiveness Summary contained in the OU2 ROD.

SUMMARY OF PREFERRED ALTERNATIVE

The Preferred Alternative discussed in this Proposed Plan addresses radiological contamination in the Armstrong Building. EPA's Preferred Alternative for OU2 is Alternative 2, which includes the following:

- Decontamination (physical and/or chemical) of radiologically contaminated building surfaces and building materials in the Armstrong Building.

- Transportation of radiologically contaminated wastes generated during the remedial action to an approved off-site facility.

The estimated cost for the Preferred Alternative is $3,500,000.

EPA is issuing this Proposed Plan to solicit public comment on the Preferred Alternative for the

Armstrong Building (OU2). EPA will select a remedy for OU2 only after the public comment period has ended and the comments received during the comment period have been reviewed and considered. As stated earlier, the public's comments will be considered and discussed in the Responsiveness Summary of the ROD, which will document EPA's selected remedy.

Based on new information and/or comments received on the Preferred Alternative, the final selected OU2 remedy may be different from the Preferred Alternative presented in this Proposed Plan.

COMMUNITY PARTICIPATION

EPA and NJDEP provide information regarding the cleanup of the Welsbach/General Gas Mantle Contamination Superfund Site to the public through public meetings, the Administrative Record file for the Site, and announcements published in the local newspaper. EPA and the State encourage the public to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site.

To ensure the community's concerns are being addressed, a public comment period lasting 30 calendar days will open July 21, 2011 and close on August 22, 2011. During this time, the public is encouraged to submit comments to EPA on the Proposed Plan.

The date, location, and time of the public meeting, and the locations of the Administrative Record files, are provided on the front page of this Proposed Plan.

For further information on the Welsbach/General Gas Mantle Contamination Superfund Site, please contact:

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ARMSTRONG BUILDING
&
SITE STUDY AREAS
WELSBACH/GGM SUPERFUND SITE
CAMDEN COUNTY, NEW JERSEY

Figure 1

ARMSTRONG BUILDING LOCATION
WELSBACH/GGM SUPERFUND SITE
CAMDEN COUNTY, NEW JERSEY

Figure 2